

Knowledge is lost without being put into practice.

Chanakya, Indian politician (c. 350–283 BCE)

## INTERNATIONAL ENVIRONMENTAL HEALTH

## New MPH Program a First for India

Not often does a new degree program make headline news, but then, in India there is nothing entirely comparable to the new master's of public health (MPH) program launched 19 January 2010 at Sri Ramachandra University (SRU) in Chennai. With environmental disease constituting roughly half the country's total disease burden, India has a dire need of the expertise the program will develop with its focus on occupational and environmental health (OEH).

"This program is the first MPH [in India] with an exclusive focus on OEH," says Kalpana Balakrishnan, a professor of biophysics and head of the Department of Environmental Health Engineering at SRU. "These graduates will be trained in recognition, evaluation, and management of OEH risks to serve industry and governmental organizations in addition to assuming roles as teachers of OEH in [this and other] MPH programs."

India faces a double whammy of traditional and modern OEH problems, including indoor air pollution (primarily due to the use of wood, dung, and other solid fuels for cooking); the microbial and chemical contamination of water; chemical, physical, ergonomic, and psychosocial hazards in the workplace; and contamination of food supplies by heavy metals,

pesticides, and microbes. Over 37 million people—more than the total population of California—are affected annually by waterborne disease, according to the international nonprofit WaterAid, and the most recent data available—published by James Leigh et al. in the September 1999 issue of *Epidemiology*—put the number of occupation-related deaths per year at an estimated 121,000. Yet the country, with one-sixth of humanity and a space program, nevertheless has few professionals trained to tackle such problems and inadequate capacity to undertake related research.

The 2-year MPH program is the fruit of a collaboration with the University of California, Berkeley, that began in 2002 with support from the International Training and Research Program in Environmental and Occupational Health (ITREOH), an initiative of the Fogarty International Center, National Institutes of Health, in collaboration with the NIEHS and the Centers for Disease Control and Prevention. "A main objective of this collaboration has been to build the capacity of staff at SRU to deliver the MPH program and undertake research," explains Kirk Smith, a professor of global environmental health at Berkeley and a principal investigator with ITREOH. Fogarty funds have brought 6 SRU faculty to Berkeley to take advanced courses in biostatistics, epidemiology, and other disciplines. Berkeley aims to continue to provide training support over at least the next 2 years.

The new MPH program covers topics such as epidemiology, biostatistics, occupational toxicology, industrial hygiene, occupational and environmental safety, exposure assessment and control, health policy and management, behavioral sciences in health, indoor air quality, analysis of airborne chemical contaminants, occupational health clinics, environmental engineering (including the management of hazardous and biomedical waste), and the use of geographic information systems. With initial graduating classes of just 10 students, Balakrishnan says, "The intake will be expanded once a critical mass of teachers is produced from the first few batches." She believes it could be at least a decade before much of a dent could be made in the subcontinent's OEH problems and that to truly meet its challenge, India would need dozens more such programs.

"It will be difficult in the short term to find students able to pay their own fees to attend until there are jobs available to make it seem worthwhile," Smith says. "It's a chicken-and-egg situation, which is one of the main reasons SRU needs to start small and build up slowly to a larger program."

Smith says other Indian universities are now considering offering new courses with OEH content, but one of the major problems they face remains the recruitment of staff capable of teaching in this area. "The production of the first 'homegrown'

graduates who can specifically fill these positions, who have firsthand experience of India's OEH problems, and who can begin research to find new ways of quantifying them and dealing with them will be a big step in the right direction," he says.

"Addressing India's occupational and environmental health concerns is vital in the future of a healthy India,"

remarks Sanjay Zodpey, director of the Indian Institute of Public Health and director of public health education for the Public Health Foundation of India, both in New Delhi. "The MPH program in collaboration with Berkeley will not only address the shortfall in trained manpower in occupational and environmental health, but also strengthen indigenous Indian research capacity in these areas."

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Left: Canals filled with waste and debris, like this waterway in Kanchipuram, a city known for its temples, are a common sight in India.

Inset: A woman from Nandgaon carries water home past the heavily fertilized sugarcane fields near her community's open well.

## POLICY

## EPA's Ground-Level Ozone Standard Redux

The U.S. Environmental Protection Agency (EPA) is taking another crack at setting National Ambient Air Quality Standards for ground-level ozone, which EPA administrator Lisa Jackson says is “one of the most persistent and widespread pollutants we face.” In March 2008, the agency revised the standards for the first time in 11 years, far longer than the 5-year interval stipulated in the Clean Air Act. This time, the interval is far shorter, and many industry and state officials are legally challenging the EPA's authority to reconsider the standard so quickly. But in announcing the proposed rule making, the agency contended it's authorized to do so because the 2008 standards aren't grounded in science and don't sufficiently protect public health or the environment, as required by the Clean Air Act.

According to the EPA, adverse health effects from elevated airborne ozone include premature death from heart or lung disease, reduced lung function, increased susceptibility to respiratory infections, and increased hospital admissions, emergency department and doctor visits, medication use, and school absences. Ground-level ozone is a by-product of atmospheric reactions between nitrogen oxides, volatile organic compounds, methane, and carbon monoxide in the presence of sunlight. The precursor chemicals typically come from combustion processes, industrial and vehicle emissions, chemical solvents, and natural sources.

The 2008 primary standard—which is designed to protect public health—was set at 75 ppb, although a 60- to 70-ppb range had been unanimously recommended by the agency's Clean Air Scientific Advisory Committee (CASAC). The secondary standard—which is designed to protect the environment—was in the same form and concentration as the primary standard, addressing just peak exposures, not cumulative exposures as CASAC had recommended. [For more information, see “Ozone Nation: EPA Standard Panned by the People,” *EHP* 116:A302–A305 (2008).]

On 7 January 2010 the EPA announced it was proposing a primary standard within the range of 60–70 ppb along with a CASAC-sanctioned secondary standard within the range of 7–15 ppm-hours (a unit that accounts for both concentration and length of exposure to that concentration). According to EPA calculations published



as a supplement to the March 2008 regulatory impact analysis, a primary standard of 70 ppb would, by the year 2020, prevent about twice as many premature deaths and nearly that many nonfatal heart attacks as a standard of 75 ppb, and would prevent more than 2.5 times as many hospital and emergency room visits and missed work and school days. A primary standard of 60 ppb, compared with 75 ppb, would prevent about 5 times as many premature deaths, about 4 times as many nonfatal heart attacks, about 8 times as many hospital and emergency room visits, and 9 times as many missed work and school days.

Just over 21% of the 3,141 U.S. counties have an ozone monitor. About 60% of the U.S. population lives in monitored counties that exceed a 70-ppb standard, and about 67% live in monitored counties that exceed a 60-ppb standard, according to data from the EPA and the U.S. Census Bureau. The percentage living in nonattainment areas could be substantially higher when the EPA makes its final determination, tentatively planned for July 2011, of which counties violate its new standards. This determination is based on the 3-year average of the fourth highest reading over an 8-hour period, and includes consideration of factors such as estimates of ozone concentrations in unmonitored counties. On the other hand, says Janice Nolen, assistant vice president for national policy and advocacy at the American Lung Association (ALA), ongoing reductions in ozone precursors are projected to lower ozone levels in the future.

The World Health Organization recommends a health standard of 51 ppb, which

appeals to Norman Edelman, chief medical officer for the ALA. “If you want to set a level that's safer for everyone, 51 is better,” he says. But he says the ALA recognizes that only 6 of the 675 monitored counties would currently meet that standard. Instead, the ALA continues to push for the lowest end of the range recommended by the CASAC. “If we can get to 60, that'll be a huge step forward,” Nolen says.

The EPA is legally prohibited from considering implementation costs when setting its standards. However, many business and government officials are highlighting costs as they lobby the agency. Calli Barker Schmidt, director of environmental communications for the National Association of Home Builders, says the home building industry may not be required to take substantial direct action to reduce ozone generation, but any construction moratoriums that may be imposed on counties that don't meet the standards could be costly for her clients. “It's like if someone misbehaves in class, then everyone has to stay inside for recess,” she says.

Howard Feldman, director of regulatory and scientific affairs for the American Petroleum Institute, says, “We call it moving the goal posts in the middle of the game. This is very real and very costly. It's going to have a major societal impact.”

The 60-day public comment period closes 22 March 2010, and the EPA plans to announce its final standards by 31 August 2010.

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## CARDIOVASCULAR HEALTH

## Exploring a Potential Link between BPA and Heart Disease

Most people in the United States are exposed to the plastic monomer bisphenol A (BPA), whether in plastic linings in food cans, containers made of hard plastic, or other plastics and foods containing BPA. Exposure to this suspected endocrine disruptor is illustrated by urine samples collected for NHANES (the National Health and Nutrition Examination Survey), for which the Centers for Disease Control and Prevention surveys thousands of adults and children. A new analysis of NHANES data published 13 January 2010 in *PLoS ONE* adds more evidence for an association between heart disease and higher exposures to BPA, even at the relatively low levels seen in the general population.

David Melzer, an epidemiologist at the University of Exeter, United Kingdom, and his colleagues first looked at NHANES data collected from 2003 and 2004; their results, published in the 17 September 2008 issue of *JAMA*, were the first to show an association between higher levels of BPA metabolites in urine and adverse adult health outcomes, including heart disease. The current analysis considered NHANES data from 2005 and 2006. Although the BPA levels in urine samples from this new group of people were lower by almost a third, the association remained between coronary heart disease and higher urinary BPA.

While this study may help inform future research, such cross-sectional studies “should not be used to demonstrate that a particular chemical can cause a particular effect,” said Steven G. Hentges of the Polycarbonate/BPA Global Group of the American Chemistry Council in a 13 January 2010 press release. And indeed, Melzer and his colleagues emphasize that because this study is cross-sectional—a snapshot in time instead of a long-term observational

investigation—they cannot say whether BPA contributes to heart disease or if heart disease changes the exposure to or metabolism of BPA in adults. “What would really help is if industry and regulators could support independent studies [to examine] whether high BPA levels are present before any disease started,” Melzer says.

“Chasing human [data] is the way forward,” says Richard Sharpe, an endocrinologist from The Queen’s Medical Research Institute in Edinburgh who did not participate in the research. NHANES provides a robust data set, he says, and the repeatability of the association with a second survey group is positive. However, that replication is somewhat incomplete because not all of the associations found with BPA in the first study were found in the second.

“The more logical interpretation of the results as they stand at the moment is that they are looking at two variables that are associated with something else,” Sharpe says. Diet, for instance, is a major contributor to heart disease in the United States and also a major source of BPA exposure. “We should remember that heart disease develops over a long period of time,” Sharpe says, “so if BPA is involved causally, a cross-sectional study such as this [*PLoS ONE* report] cannot show this.”

Scott Belcher, a scientist at the University of Cincinnati, says the association in humans is “not super surprising in light of our animal studies and because we already know estrogens are related to various cardiovascular end points.” Belcher’s team reported at the June 2009 Endocrine Society annual meeting that BPA exposure *in vitro* in muscle cells and in whole hearts from female rodents leads to arrhythmias, and they recently received American Recovery and Reinvestment Act funds from the NIEHS to conduct further research on BPA in mice. Meanwhile, pending the release of an updated toxicology review for BPA, the Food and Drug Administration announced in January 2010 it is “taking reasonable steps to reduce human exposure to BPA in the food supply.”

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## The Beat

by Erin E. Dooley

### EPA Releases Utilities’ Plans for Coal Ash Impoundment Safety

Since the December 2008 collapse of the Kingston Fossil Plant coal ash impoundment in Tennessee, which spilled 5.4 million yd<sup>3</sup> of ash into the Emory River, the U.S. EPA



Erosion monitoring and control are key elements of several utilities’ plans.

has been conducting on-site assessments of impoundments at electric utilities across the country. On 4 February 2010 the agency released plans submitted by 22 utilities that detail how they are making their coal ash ponds safer through measures such as adding riprap and vegetation to strengthen earthen impoundment walls. In a press release the EPA said it is “continuing to review the reports and technical recommendations, and is working with the facilities to ensure that the recommendations are implemented in a timely manner.”

### Rating the Sustainability of Roads

In January 2010 the University of Washington and engineering firm CH2M Hill released Greenroads™, a new system that rates the sustainability of road design and construction projects similarly to how programs such as LEED® rate and certify buildings. Minimum requirements for Greenroads certification include a noise mitigation strategy and a life cycle energy and emissions analysis for paving materials. Extra points are awarded

for voluntary measures such as avoiding light pollution, using permeable pavements to reduce stormwater runoff, and adding lanes for bicycles and pedestrians.

### New Lighting from Nanofibers

RTI International has developed a novel lighting technology that it says is 5 times more energy-efficient than incandescent bulbs and, unlike compact fluorescent lamps (CFLs), uses no mercury-containing components. RTI’s new technology, which was partially funded by the Department of Energy, pairs high-performance nanofiber-based reflectors with photoluminescent nanofibers to create light its developers say has better color rendering properties than is typically found with CFLs. The new technology could hit the market within 3–5 years.

### What Cd Means to CVD

A study by Junenette Peters and colleagues in the February 2010 issue of *Environmental Research* adds evidence to the idea that exposure to low levels of cadmium may be linked to cardiovascular disease. Using data

## INFECTIOUS DISEASE

## Americas' Dengue Escalation Is Real—and Shifting

Although there has been a perceived increase in dengue cases in the Americas since 1980, the epidemiology of this disease has not been well documented. A new analysis of 3 decades' worth of data indicates, however, that dengue is indeed hyperendemic in the Americas—that is, exhibiting a sustained and growing high incidence. All told, the incidence rate of dengue rose 4.3-fold between the periods 1980–1989 and 2000–2007, the team reports, and the rate of the more severe dengue hemorrhagic fever (DHF) rose 8-fold. Their findings, based on data from the Pan American Health Organization and selected ministries of health, were published in the January 2010 *American Journal of Tropical Medicine and Hygiene*.

Dengue is spread by mosquitoes, predominantly *Aedes aegypti*. It affects an estimated 50 million people annually in about half the world's countries, and the numbers continue to rise even as many cases go unreported. The 4 known serotypes of the flavivirus that causes dengue induce symptoms such as fever, headache, liver dysfunction, and muscle, joint, or abdominal pain. DHF and dengue shock syndrome, which is frequently fatal, appear to be more likely after a person is reinfected by unique strains of virus of a different serotype.

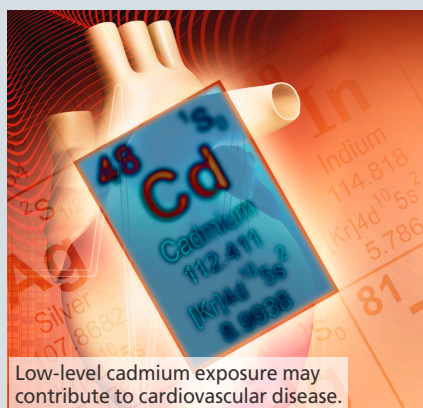
There is no effective vaccine for dengue or treatment besides rest and drinking plenty of fluids. The disease is believed to have been present in the Americas for more than 200 years and was effectively controlled in the 1950s and 1960s through infrastructural changes such as better public health systems, housing, piped water systems, and systematic pesticide application. Sustained control efforts waned when it appeared the disease had been beaten, and epidemic dengue began a dramatic re-emergence in the late 1970s [see “Dengue Reborn: Widespread Resurgence of a Resilient Vector,” *EHP* 116:A382–AA388 (2008)].

From 1980 through 1989 more than 1 million cases of dengue were reported, mostly in Hispanic Caribbean countries, followed closely by Central America and Mexico. More recently, the number of cases has soared, with more than 4.7 million reported between 2000 and 2007. Nearly two-thirds of these cases occurred in Brazil, Paraguay, Argentina, Chile, and Uruguay; the incidence rate rose more than 15-fold from 1980–1989 to 2000–2007. The rate in the Andean subregion (Bolivia, Colombia, Ecuador, Peru, and Venezuela) increased more than 7-fold. It tripled in the non-Hispanic Caribbean and doubled in Central America and Mexico. The worst incidence of DHF for 2000–2007, at 7.3% of all cases, was in the Andean subregion. For all the Americas, the DHF percentage for 2000–2007 was 2.3%, nearly double the rate for 1980–1989.

There is a consistent connection between the local rainy season and increased cases, but the evidence of a dengue–climate change link remains incomplete. “Global climate has become generally more suitable for dengue over the past fifty years,” says Simon Hales, a senior research fellow at New Zealand's University of Otago whose areas of expertise include epidemiology and climate variability. “However, observed changes in dengue cannot yet be linked to climate change.”

Duane Gubler, director of Duke University's Emerging Infectious Disease Research Program in Singapore, says the increased frequency of dengue is largely driven by uncontrolled urbanization and lack of effective vector control in tropical and subtropical developing countries, combined with travel to and from those areas by hundreds of millions of people via modern transportation. Other suspected contributors include increased spread of the 4 serotypes and improved reporting. To help counter the dengue threat, “a vaccine will be an important tool for prevention and control,” says Gubler. “But we should not ignore vector control, especially in view of the emergence of other *Aedes aegypti*–transmitted diseases such as yellow fever and chikungunya.”

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Low-level cadmium exposure may contribute to cardiovascular disease.

from the National Health and Nutrition Examination Survey, the team found that a 50% increase in blood cadmium was associated with a 35% increase in stroke prevalence and a 48% increase in heart failure prevalence, while the same change in urinary cadmium was associated with 9% and 12% increases, respectively. Although smoking explained their findings in part, the researchers believe other exposures to cadmium, such as through food and metal and ceramic food containers,

should be considered in both research and risk assessment for cardiovascular diseases.

### China Completes First National Pollution Census

On 9 February 2010 the Chinese government announced it had completed the country's first national census of pollution, a 2-year effort by almost 600,000 staff that mapped nearly 6 million pollution sources. This survey is the first time Chinese environmental authorities have been able to include agricultural sources of pollution in their data. Among other applications, these findings will help guide China's next 5-year environmental protection plan to begin in 2011. However, the full survey results are available only to selected government officials. Environmental advocates are calling for the government to release details of the survey to the public.

### Communities Warm Up to Woodstove Changeout Programs

As part of the U.S. EPA's Great American Woodstove Changeout campaign, more than 45 U.S. communities now provide financial

incentives to residents who trade in old stoves for newer, less polluting models or pellet, gas, or propane appliances. Many of the older woodstoves in use can emit up to 10 times as much particulate matter as newer stoves, according to the EPA. As of January 2010, the agency estimated more than 13,000 woodstoves and fireplaces had been replaced under such programs, saving an estimated 248 tons of particulate matter emissions and \$84 million in health benefits per year.

